

3.5 Exploring Space



Space Shuttle Challenger

1986

(exploded 73 s into flight)





Challenges of Space Travel

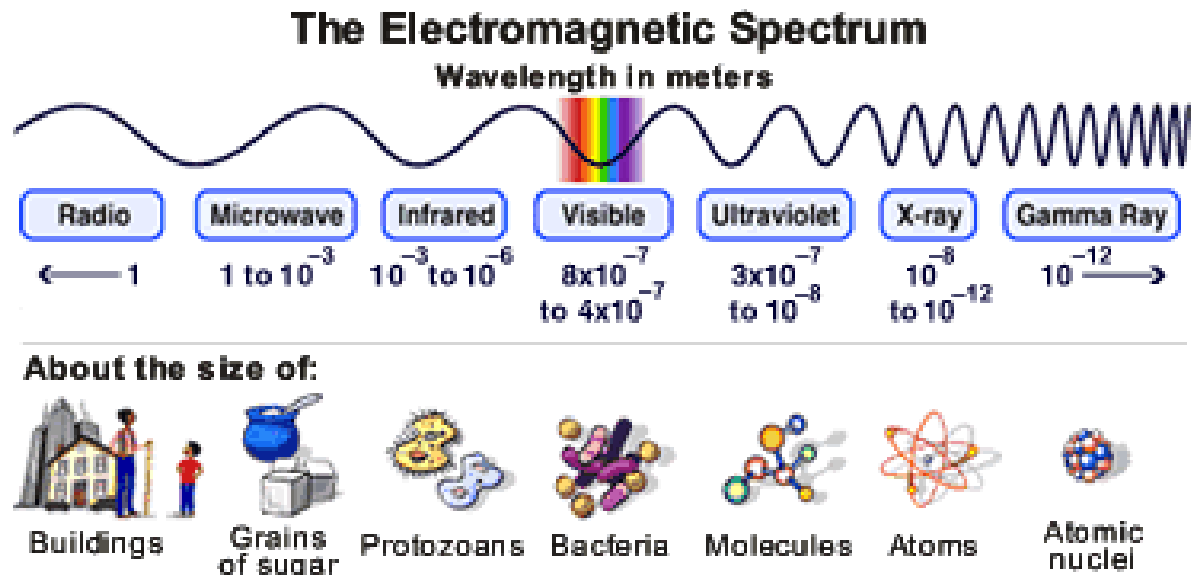
<do not make notes>

- Difficult & Dangerous
- Very expensive
- Resources: food, air, equipment, etc...
- Instruments are very expensive
- Social, political and ethical concerns
- Waste water from crew members is distilled, filtered, and processed.
- Used for drinking, cleaning, cooking, and experiments



Telescopes

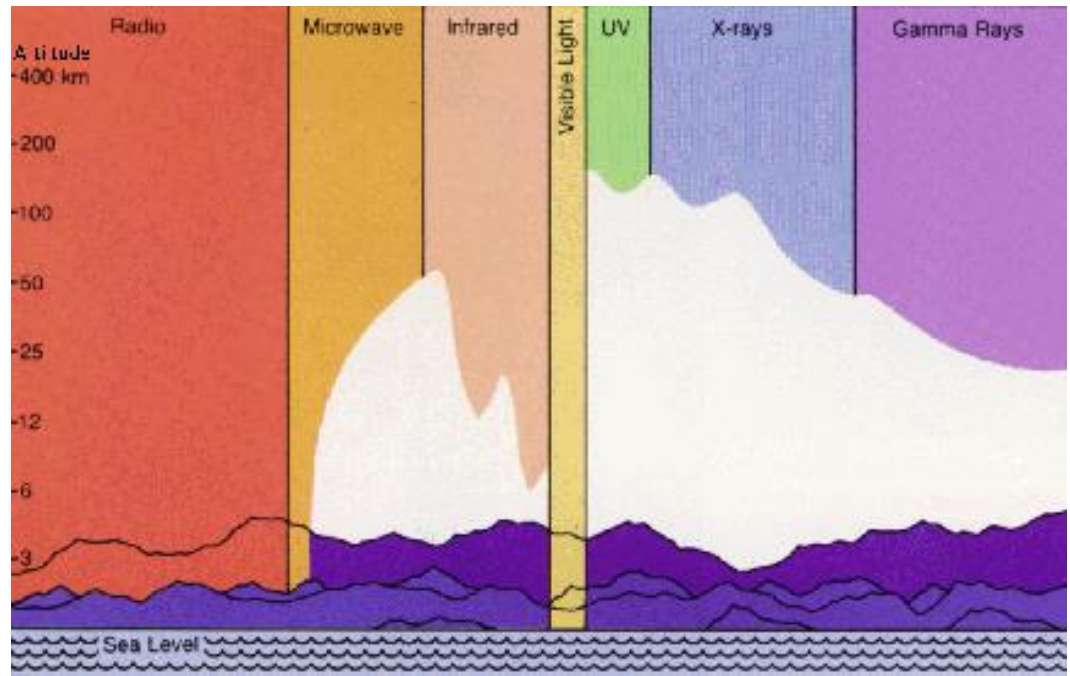
- It is safer and less expensive to use instruments to study space.
- Instruments can also measure electromagnetic radiation outside the visible spectrum



The Electromagnetic Spectrum

- Electromagnetic radiation includes Visible light, Gamma Rays, X-rays, UV rays, Infrared, microwaves and radiowaves
- Stars and planets emit electromagnetic rays that can tell us information about the object.
- The only waves that make it to Earth are the **visible**, **radio**, and some **infrared rays**, therefore, to study celestial objects telescopes must also be sent into space.

See table 7.32 p.281



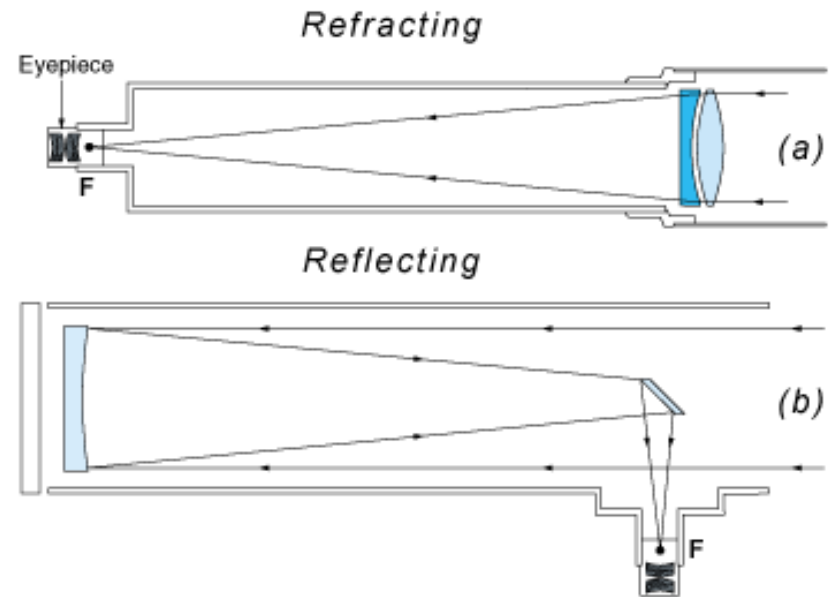
Telescopes

➤ Optical Telescopes

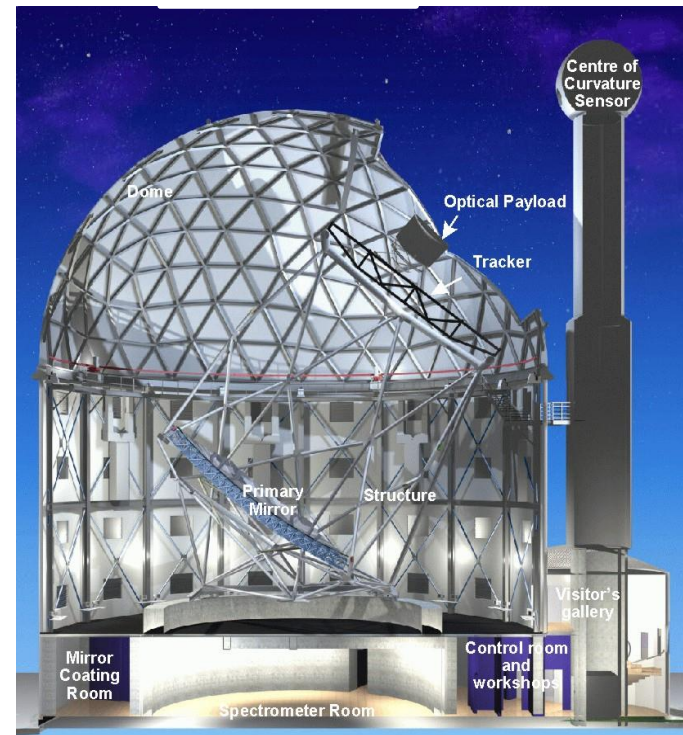
Detects visible light

2 types:

- **Refracting** telescopes uses a lens to collect light from an object.
- **Reflecting** telescopes uses a mirror to collect the light from an object.



The Southern African Large Telescope (SALT) is an optical telescope capable of recording stars a billion times too faint to see with the naked eye. →





➤ Non-Optical Telescopes

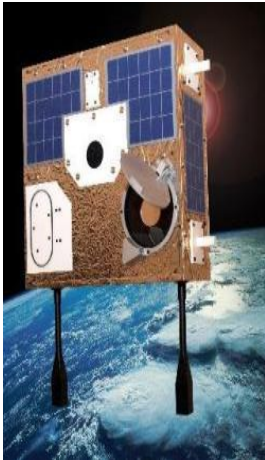
Examples include: **Radio** and **Infrared** telescopes.

Radio telescopes can detect radio waves when it is cloudy or night time.

Radio telescopes are used by an organization called SETI (Search for Extraterrestrial Intelligence) to search for signs of intelligent life on other planets. So far, there have been no genuine contact.



World's largest single dish radio telescope is in Puerto Rico.



Examples of Working Telescopes in Space

1. Hubble Space Telescope (HST)

- An optical, ultraviolet, and near-infrared telescope fitted with cameras.
- Launched by NASA and ESA in April 1990.
- Ultimate tool for studying distant galaxies.

2. SOHO ([link orbit](#))

Make your own notes from p. 347 on:

3. MOST



Orbiters and Landers

- *Mars Climate Orbiter (MCO)*
 - was a 338 kilogram robotic space probe launched by NASA on December 11, 1998 to study the Martian climate, atmosphere, and surface changes and to act as the communications relay. *Sept 23, 1999 lost contact. WHY?*
- *Mars Polar Lander*
 - The Mars Polar Lander, also known as the Mars Surveyor '98 Lander, was a 290-kilogram robotic spacecraft lander launched by NASA on January 3, 1999 to study the soil and climate of Planum Australe, a region near the south pole on Mars. On December 3, 1999, failed to reestablish communication with Earth. Why?
- *Phoenix Lander ([link](#))*
 - **Phoenix** was a robotic spacecraft on a space exploration mission on Mars under the Mars Scout Program. Cost US \$386 million.

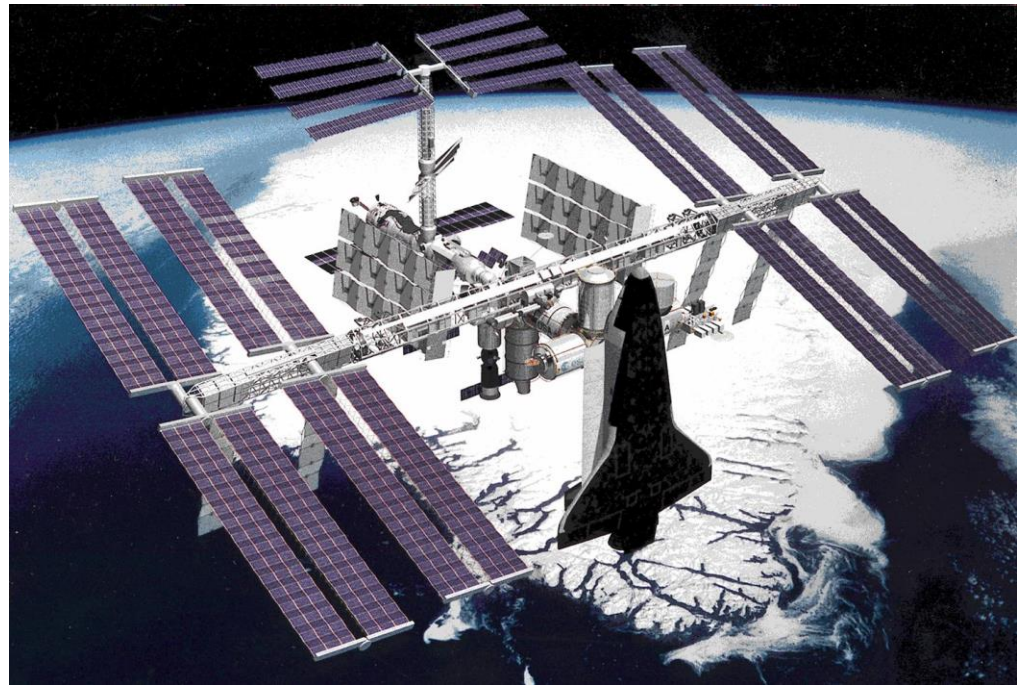


Satellites

- A human-made object that orbits Earth
- Importance of Satellites:
 - Meteorology (study of weather)
 - Climatology (study of climates)
 - Oceanography (study of oceans)
 - Hydrology (study of water)
 - Transmit telephone, television, and radio signals (many are geosynchronous)
 - The Internet
 - Search and rescue (GPS)

International Space Station (ISS)

- Collaboration between countries (US, Russia, Canada, Japan, Brazil, & European countries).
- Current plan to de-orbit in 2016 or extend to 2028 (funding pending).
- Orbit is approximately 330 km above the Earth (low Earth orbit = LEO).



Interactive videos of the ISS

<https://www.youtube.com/watch?v=DWi29sb8nls>



Canada's Contribution

- **Canadarm 2** (robotic system used to move supplies, service equipment, and assist on spacewalks).
- **Dextre** (performs functions outside ISS – reduces the need for spacewalks)



Canadian Astronauts

(*note names)

Current

*[Chris Hadfield](#)

*[Julie Payette](#)

[Robert Thirsk](#)

[Jeremy Hansen](#)

[David Saint-Jacques](#)

Retired

*[Roberta Bondar](#)

*[Marc Garneau](#)

*[Steve MacLean](#)

Mike McKay

[Ken Money](#)

[Bjarni Tryggvason](#)

[Dave Williams](#)





Assigned Work

- 1) Make your own notes from p. 347 on MOST
- 2) Orbiters and Landers why were they lost?
 - 1) Mars Climate Orbiter (MCO)
 - 2) Mars Polar Lander
- 3) Read p. 278 to 283
- 4) Read p. 345 to 348
- 5) Questions p. 351 # 6,7,8 and p.284 # 1,2,3,4